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Diversity and distribution of aromatic plants in forests of Gorakhpur division, U.P., India

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ABSTRACT : A field survey of wild aromatic plants distributed in forests of Gorakhpur division indicates 44 species of aromatic plants that belong to 32 genera and 14 families. Of which many are being used in day to day medical therapy. In addition to this the richest period for flowering and fruiting in aromatic plants was Dec.-April. Out of 14 families studied Asteraceae occupied top most position; however Araceae, Cannabinaceae, Capparidaceae, Chenopodiaceae and Polygonaceae represented only one species of each. This study indicates that the area harbors a high diversity of aromatic plants and their application as medicines may be exploited.

Keywords: Aromatic plants, forests, medicinal value.

INTRODUCTION

The use of aromatic plants has been out of focus throughout the history. At present, this is a popular treatment strategy for a variety of ailments. According to WHO estimate, about 80% of the population in developing countries depends directly on plants for its medication (Kosalge and Fursule, 2009). India has a rich assortment of diversity of medicinal and aromatic plants distributed in different geographical and ecological conditions in the country. Out of total 17,500 species of flowering plants in India only 1300 species are of aromatic nature (Uniyal *et al.*, 2002). In present study an attempt has been made to collect the aromatic plants from different forests of Gorakhpur division with their collection number. Besides, observation on habit, habitat, local name, flowering/fruiting and medicinal uses in human welfare have also been made.

Study area and Vegetations

The forests taken in present investigation are situated in Eastern part of Uttar Pradesh between latitude of 27º05' to 27º25' North and longitude of 83º20' to 84º10' East. The division comprises Maharajganj, Gorakhpur, Kushinagar and Deoria districts. Out of which forests are only situated in Maharajganj and Gorakhpur districts. The soil of this area is gangatic alluvial brought down by rivers like Ghaghara, Rapti, Rohin and Gandak from the Himalayas. The rainfall varies considerably from year to year. The monsoon rains commence during June and come to an end in September but may persist till October. The minimum temperature goes down to 6ºC in the month of January & maximum up to 43ºC in the month of June.

The Gorakhpur Division is a tarai region has dense forest covers close to the foothills of Himalayas. All the forests of Gorakhpur Division including Achalgarh, Banki, Campierganj, Chowk, Kushmahawa, Kushmahi, Lehradevi, Madanpur (out of Gorakhpur Division), Madhualia, Nichlaul, Pakari, Tehrighat and Tilkonia are rich in species composition of higher plants. The vegetation of forests consists of herbs, shrubs, trees and climbers. Trees, shrubs and climbers occur throughout the year and form permanent vegetation, while herbaceous plants mostly appearing during rainy season, decreasing during winter and finally become depleted in peak summer.

METHODOLOGY

The present work is based on an intensive survey of aromatic plants of Gorakhpur Division during 2006-2009; in which periodic excursions were made and aromatic plants were collected in flowering and fruiting conditions. The dominance of aromatic plants was recorded on visual basis for presence and absence of species. The plant specimens were assigned collection numbers; their localities and other necessary field information were recorded in field data book. During visit local name, medicinal and traditional uses of plants by native people were noted on the spot and confirmed with the help of literature. The specimens were pressed dried, prepared herbarium and identified using floras (Srivastava, 1976; Singh *et al*., 2000) as well as by matching their specimens lodged in departmental herbarium of Gorakhpur University and BSI (NRC) Dehradun. The herbarium of collected plants was deposited to BSI, Dehradun.

Enumeration of aromatic plant species

Aromatic plant species collected from forests of Gorakhpur division are enumerated here alphabetically along with common name and mode of application.

Acorus calamus Linn. (Bach)

A semi aquatic, rhizomatous perennial herb, rhizome creeping, much branched, cylindrical, light brown, white and

spongy within. Leaves bright green, distichous, thickened in the middle, margin wavy. Flowers light brown, densely packed in sessile cylindrical spadix. Fruits oblong, turbinate berries.

Dried powder of rhizome is given to children twice daily in fever (Tomar, 2008).

Adenostemma lavenia (L.) O. Kuntze **(Bhenguar)**

An erect annual herb. Leaves simple, opposite, oblong, ovate, sessile or petiolate, crenate or coarsely serrate. Heads homogamous, white, discoid, arranged in dense panicles or corymbs. Calyx modified into pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, brown with glandular tubercles.

The extract of plant is used as diuretic, crushed leaves applied to cuts and wounds, and also to treat bites of poisonous insects and caterpillars (Chopra *et al.*, 2006).

Artemisia nilagirica (Clarke) Pamp. **(Dauna)**

An aromatic, perennial shrub, often gregarious, pubescent or villous throughout. Leaves ovate, bipinnate to tripinnate, deeply pinnatisect, pubescent above, white tomentose beneath. Heads homogamous, flowers yellowish white, sessile in sub-erect or horizontal panicled racemes. Calyx modified into pappus. Corrola 5, tubular. Anther 5, syngenesious. Fruits achene.

Used in chronic fever, swelling and inflammations of liver also employed as tonic and stimulant (Ambasta, 2006).

Blumea eriantha DC. **(Kukuraunha)**

An erect, puberulous, aromatic herb. Leaves simple, petiolate, alternate, obovate or elliptic, apiculate, margin irregularly toothed, membranous, pubescent on both surfaces. Heads heterogamous, yellow clustered into axillary and terminal cymes. Calyx modified into pappus. Corolla 5. Stamens 5, syngenesious. Fruits cypsela, dark brown.

Half cup of leaf infusions taken twice a day for diuretic (Chopra *et al.*, 2006).

B. laciniata (Roxb.) DC. **(Kukuraunha)**

An erect, aromatic, pubescent, annual herb. Leaves simple, alternate, variable, usually large, runcinate-lyrate below and sub-pinnatifid, spinulose above, hairy on both surfaces. Heads heterogamous, yellow in dense to lax panicles. Calyx modified into pappus. Corolla 5. Stamens 5, syngenesious. Fruits cypsela, flattened**.**

Plants used against mouth disease of cattle. The essential oils used as antifungal and antibacterial agent (Asolkar *et al.*, 2005).

B. mollis DC. **(Kukuraunha)**

An erect, annual, aromatic leafy herb. Leaves simple, alternate, petiolate, elliptic-lanceolate or obovate, irregularly toothed or serrate, glandular on both surface. Heads heterogamous, purplish in terminal or axillary spiciform dense cymes or panicles. Calyx modified into pappus. Corolla 5, tubular. Stamens 5, syngenesious. Fruits cypsela, linear.

The decoction of whole plant used to treat diarrhea (Asolkar *et al*., 2005).

Caesulia axillaris Roxb. **(Bangra)**

An erect or sub-erect glabrous marshy annual herb. Leaves alternate, sessile, lanceolate, acuminate, tapering to the auricled base. Heads globose, homogamous, flowers purplish or white, connate together in compound head. Calyx modified into pappus, axillary sessile. Corolla 5. Anther 5, syngenesious. Fruits cypsela, dark brown.

A mixture of this plant and khesari in water is given to cattle in stomach disease; leaf is used in treatment of goiter, plant used in baldness and diarrhea (Asolkar *et al.*, 2005).

Callicarpa macrophylla (L.) Vahl **(Priyangu)**

An erect shrub. Leaves elliptic or ovate-lanceolate, crenate to serrate, acuminate, upper surface wrinkled, lower cottony. Flowers pink in dense axillary, globose, cymes. Calyx 5, companulate. Corolla 5, tubular. Stamens 4. Fruits drupe, white.

Roots yield an essential oil used in stomach disorder, leaves warmed and applied to rheumatic joints (Ambasta, 2006).

Cannabis sativa Linn. **(Bhang)**

A scarsely branched, aromatic herb. Leaves upper 1-3 and lower 5-11 partite, lobes lanceolate, serrate. Flowers small, greenish white, dioecious. The male flowers in axillary panicled cymes while female flowers in axillary racemes. Fruits compressed, crustaceous nut.

A poultice of leaves is applied externally around the anus for one month to cure piles (Tomar, 2008).

Chenopodium ambrosioides Linn. **(Banbhathuwa)**

An erect, much branched, aromatic herb or under shrub. Leaves oblong–lanceolate or oblong ovate, obtuse or acute, sinulate-dentate. Flowers green, minute in axillary and terminal simple or paniculated leafy spikes. Perienth 5-lobed enclosing the fruits. Stamens 5. Fruits utricle membranous brown.

Used as an anthelmintic against many forms of intestinal parasite (Mishra *et al*., 2008).

Clausena pentaphylla (Roxb.) DC. **(Ratanjot)**

A small aromatic deciduous shrub. Leaves imparipinnate, tri-hepta foliolate; leaflets alternate or sub-opposite, ovate-elliptic, oblong, lanceolate, margins crenulate, glabrous, gland punctate. Flowers yellowish or greenish white in terminal, downy panicles. Calyx and corolla 4-5 each. Stamens 10. Fruits berry ovoid, orange.

Bark is applied to fresh wounds in powdered form for quick healing (Ali and Dixit, 1989).

Colebrookea oppositifolia Sm. **(Bantulsi/Pansara)**

An erect, aromatic, spreading, white tomentose shrub with grooved, sub-quadrangular branches. Leaves elliptic, oblong, crenate-serrate, acute hairy. Flowers white, small in clustered spikes. Calyx deeply 5-lobed, acrescent. Corolla small, 4 lobes. Stamens 4. Fruits nutlets black.

Leaves used in cuts, wounds and burns. Roots used in hysteria and epilepsy (Ambasta, 2006).

Curcuma aromatica Roxb. **(Jangalihaldi)**

A rhizomatous herb with a thick tuberous aromatic root stocks. Leaves linear, lanceolate, an apparent stem is formed by rolled up leaf sheath. Inflorescence raceme, flowers red in colour. Calyx 3, united. Corolla 3, unequal, tubular. Stamen 1. Fruits loculicidal cypsela.

Rhizomes powder used in fever, contusions and sprains (Ambasta, 2006).

C. zedoaria Rosc. **(Kachur)**

A rhizomatous underground herb. An apparent stem is formed by rolled up leaf sheath. Leaves alternate spirally arranged, linear. Inflorescence spikes arise from the sheaths. Flowers yellow.

Calyx 3, united. Corolla 3, unequal, tubular. Fruits loculicidal cypsela.

Used as stimulant tonic, stomachic and relieve from joints pains (Chopra *et al*., 2006).

Cyperus brevifolius (Rottb.) Hassk. **(Mutha)**

An erect, slender perennial sedge with horizontal rhizome. Leaves linear, erect, spikes aggregated into terminal solitary globose green heads. Spikelets lanceolate or ovate-lanceolate, 1- flowered. Perienth absent represented by bristles or scales or hairs. Stamens 3. Fruits nuts, yellowish brown.

Readily eaten by cattle. Leaves used in diarrhea (Asolkar *et al*., 2005).

C. monocephalus Endl. **(Musta)**

An erect, glabrous sedge with slender, elongated creeping rhizomes. Leaves linear, acuminate. Spikes solitary, sub-globose, white, spikelets 1- flowered. Rachilla deciduous. Stamens 3. Fruits nuts, oblong.

Decoction of aromatic rhizomes used as diuretic, demulcent and tonic, also given in fever and diabetes (Ambasta *et al.*, 2006).

C. squarrosus Linn. **(Motha)**

A glabrous, annual sedge with numerous tufted, fibrous roots. Leaves arising near base of stem, usually shorter than stems, linear, tapering in acute apex. Inflorescence umbellate with at least one sessile head like spikes of spikelets. Heads globose or oblong, spikelets oblong, brownish, 10-12 flowered. Stamen 1. Fruits narrowly obovoid.

Decoction of whole plants useful in diarrhoea, plants diuretic, astringent (Chopra *et al*., 2006).

C. triceps (Rottb.) Endl. **(Apavisha)**

An erect, small, glabrous, annual sedge with small rhizome. Leaves narrow, acuminate, spikes 3-5, ovoid or oblong, white aggregated into a compact head. Rachilla deciduous, perienth absent represented by bristles, scales or hairs. Spikelets, 1-flowered. Fruits nut oblong, ellipsoid and pale brown.

Decoction of plants is given in fever, the root oil used for stimulating liver and to relieve pruritus (Choudhury *et al*., 2010).

Erigeron bonariensis Linn. **(Bonaria)**

An erect, hairy, deep rooted annual herb. Leaves simple, alternate, upper sessile, obovate-oblong, coarsely toothed. Heads purplish, in corymbose panicles, heterogamous. Calyx modified into pappus. Corolla 5, tubular. Stamens 5, syngenesious. Fruits cypsela, oblong, hairy.

Plants used as stimulating diuretic in febrile condition (Kala, 2005).

E. canadensis Linn. **(Jrayayupriya)**

An erect, slender, much branched, pubescent hairy annual herb. Leaves simple, alternate, upper sessile, narrowly linear or linear–lanceolate, entire, acute, base cuneate. Heads yellowish–white, heterogamous in elongated branched panicles. Calyx modified into white hairy pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, dirty white.

Decoction of whole plant given for diarrhoea and dysentery (Chopra *et al*., 2006).

Eugenia heyneana (L.) Wall. **(Kathjamun)**

A small to medium sized tree. Leaves narrow, lanceolate, acuminate, glabrous. Flowers greenish white in panicles. Calyx and corolla 4-5 each. Stamens numerous. Fruits berry, crowned by cup like calyx-limb, brown in colour.

Root chewed for relief from tooth ache, used as vermicide, flowers used in inflammation (Mishra *et al.*, 2008).

Eupatorium cannabinum Linn. **(Tangol-lati)**

An erect, suffrutescent, perennial herb. Leaves simple, opposite, petiolate, lanceolate, acute or acuminate, coarsely serrate, attenuate at base. Heads purplish, homogamous in terminal or axillary corymbs. Calyx modified into hairy pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, cylindrical, black.

Diuretic, herb employed as purgative (Ambasta, 2006).

E. odoratum Linn. **(Ayapana)**

An erect perennial shrub, stem pubescent. Leaves simple, petiolate, opposite, decussate, ovate, dentate, acute or acuminate, pubescent on both surfaces. Heads purplish, homogamous, in branched corymbose cymes. Calyx modified into hairy pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, fusiform black.

Decoction of leaves haemostatic, aqueous extract of shoots cardiac stimulants (Awasthi, 1991).

Glycosmis pentaphylla Corr. **(Karjeer)**

An evergreen shrub. Leaves tri-pentafoliolate; leaflets ovate-lanceolate, acute or acuminate, entire, dark green, glabrous. Flowers small, white in terminal or axillary pubescent panicles. Calyx & corolla 4-5 each. Stamens 10. Fruits berry, pink or blue.

Brush of stem is used for clean the teeth in pyorrhea. Juice is applied for fever and liver complaints, leaves considered good antidote for skin trouble & stomach ache (Natrajan *et al*., 1999).

Grangea maderaspatana (L.) Poir **(Jhinki mundi)**

A prostrate or sub-erect, villous, annual aromatic herb, forming circular patches at the ground. Leaves alternate, sessile, pinnatifid or lobulate, coarsely toothed, pubescent on both surfaces. Heads yellow, heterogamous, globose, solitary or rarely in pairs on leaf opposed peduncles. Calyx modified into pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, pale brown.

Half cup of leaf infusion taken 2 times a day in obstructed menstruation, infusion of leaves also considered as stomachic, deobstruent and antispasmodic (Choudhury *et al*., 2010).

Gynandropsis gynandra (L.) Briq. **(Hulhul)**

An erect, spreading glandular-pubescent annual herb. Leaves digitately pentafoliolate, obovate, acute, entire or serrulate. Flowers white, sub-corymbose, solitary in the axis of leafy bracts, raceme. Calyx 4. Corolla 5. Stamens 4-many. Gynandrophore present. Fruits capsule, oblong, dark brown.

Bruised leaves used in headache, rheumatism and other local pains. Seeds rubefacient and anthelmintic (Chopra *et al.*, 2006).

Gynura nepalensis Benth. **(Jali)**

An erect, annual herb. Leaves simple, longe, alternate, ramale and cauline, lanceolate or ovate, obovate-lanceolate, unequally, tripinnatifid, dentate or entire, acute. Heads pinkish disciform, homogamous in terminal panicled corymbs. Calyx modified into pappus. Corolla 5, tubular. Anther 5, syngenesious. Fruits cypsela, brown.

Leaves used in digestion, lotion of leaf employed as mild stomachic (Kala, 2005).

Hygrophila difformis Linn. **(Sarpat)**

An erect or decumbent, pubescent aromatic, annual herb with quadrangular stems swollen at the nodes and rooting below. Leaves petiolate, ovate, crenate-serrate on both sides. Flowers bluish white or purplish, in axillary whorls. Calyx tubular, 5-fid. Corolla 2-lipped. Stamens 4, didynamous. Fruits capsule, narrow, sessile.

Leaves edible, used for poulticing wounds and in tooth ache, antioxidant activity (Debasish *et al.*, 2010).

H. pinnatifida Dalz. **(Godadi)**

An aromatic herb with tetragonous stems glandular, pubescent, swollen at the nodes. Leaves opposite, oblong-lanceolate, sub-obtuse or acute, deeply pinnatifid. Flowers purplish, solitary or in lax spikes. Calyx 5. Corolla bilipped. Stamens didynamous. Fruits capsule, sessile.

Decoction of whole plant taken in diarrhea (Chopra *et al*., 2006).

Lantana camara Linn. **(Ghaneri)**

A straggling or scandent, aromatic shrub with recurved prickles. Leaves ovate or ovate-oblong with cordate or sub-cordate base, scabrid on both side, crenate-serrate. Flowers orange yellow or pink in axillary, spicate heads. Calyx small, membranous 4-5 toothed. Corolla – tube cylindrical, 4-5. Stamens 4, didynamous. Fruits drupe, black.

Used for itch, an antiseptic for wounds, decoction given in tetanus and malaria (Mishra *et al*., 2008).

L. indica Linn. **(Ghaneri)**

A hairy scandent shrub, branches-straggling, armed with scattered, prickles. Leaves ovate-oblong, crenate-serrate, acute or sub-obtuse. Flowers white, purple or yellow in axillary head or spike. Calyx 4-5 toothed, small. Corolla 4-5, tube cylindrical. Stamens 4. Fruits drupe purple when ripe.

Leaves used as a cure for snake-bite (Asolkar *et al*., 2005).

Leonotis nepetaefolia R.Br. **(Dhompo)**

An erect annual herb with grooved, puberulous, quadrangular stems. Leaves ovate, coarsely crenate-serrate, acute. Flowers orange-scarlet in dense globose axillary whorls. Calyx with 8-9 rigid teeth, teeth sharply spinescent. Corolla bilipped. Stamens 4. Fruits nutlets black, linear to oblong.

Inflorescence put in 50gm ghee, boiled to viscous paste and orally administered two spoon full a day for cough. Plants boiled in mustered oil and applied over waist to relieve pain, flowers and seeds used in cuts, wounds and burns (Chopra *et al*., 2006).

Leonurus sibiricus Linn. **(Guma)**

An erect, glabrous or pubescent, annual herb. Stems bluntly quadrangular. Leaves palmately pinnatifid, linear,

lanceolate. Flowers bluish-red in axillary whorls. Calyx turbinate, 5- teeth. Corolla 5, bilabiate. Stamens 4, didynamous. Fruits nutlets, black.

Dried leaves and flowering tops diuretic, prescribed in hysteria and heart palpitation (Chopra *et al*., 2006).

Leucas aspera Spreng **(Gooma).**

An erect or diffused branched annual herb with hispid, quadrangular stems. Leaves elliptic-oblong, linear, lanceolate, entire or crenate, acute. Flowers white in terminal and axillary whorls. Calyx 5, striate, 6-10 toothed. Corolla bilabiate (2/3). Stamens 4, didynamous. Fruits nutlets, brown.

Juice of leaves applied externally in chronic skin eruptions and painful swelling, anti-inflammatory (Natarajan *et al*., 1999).

L. cephalotes (Wild) Link. **(Gooma)**

An erect, hairy, annual herb. Stem obtusely quadrangular. Leaves ovate, linear-lanceolate, crenate-serrate, sub-acute, and pubescent. Flowers white in large dense terminal whorls. Calyx striate, 6-10 toothed. Corolla 2/3. Stamens 4, didynamous. Fruits nutlets, brown.

Juice of leaf mixed with honey is taken in cough, the aqueous extract of leaves in constipation. Flowers and leaves chewed in tooth-ache and gum disorder (Ambasta, 2006).

Lippia nodiflora Rich. **(Bhuiokra)**

A straglling aromatic shrub. Leaves ovate, crenate-serrate, base obtuse, decurrent, rugose. Flowers pink, in dense cylindrical spikes. Calyx lobed or toothed. Corolla 5, united. Stamens 4. Fruits small, dry. Seed pyrenes.

Considered as stomachic (Ambasta, 2006).

Nepeta hindostana (Roth) Haines**. (Bilaiyalotan)**

An erect or ascending herb with quadrangular, grooved, pubescent branches. Leaves ovate or sub-orbiculate, crenate, obtuse, base-cordate or truncate. Flowers bluish purple, in long peduncled axillary cymes. Calyx tubular, 5 toothed. Corolla bilipped. Stamens 4, didynamous. Fruits nutlets, light brown with white spot.

The whole plant used as a cardiac tonic, decoction used as gargle (Chopra *et al*., 2006).

Ocimum canum Sims. **(Bantulsi)**

An erect, much branched, pubescent, annual herb. Leaves elliptic-lanceolate, entire or serrate, acute at both end, glabrous. Flowers white or purple in close whorls of terminal racemes. Calyx 5, bilipped, companulate. Corolla also bilabiate. Stamens 4. Fruits nutlets, ellipsoid, black.

Decoction of leaves used in epilepsy and hysteria (Asolkar *et al*., 2005).

Piper sylvaticum Roxb. **(Pahari-pipal)**

A slender, creeping undershrub. Leaves alternate, ovate or cordate, caudate, shortly acuminate. Flowers spicate, greenish, spikes dioecious. Stamens 2-4, arranged in axillary and terminal. Fruit berries crowded in cylindrical spikes, red when ripe.

Fruits carminative, used in food preparations (Chopra *et al*., 2006).

Pogostemon heyneanus Benth. **(Pachouli/Bhantwas)**

A large aromatic herb. Leaves lanceolate, serrate-acute or acuminate, base obtuse. Flowers white tinged with pink in pubescent cylindrical spikes. Calyx 5- toothed. Corolla bilipped 4-lobed, bracts foliaceous. Stamens 4. Fruits nutlets, reddish brown.

Decoction of leaves given in cough and asthma (Mishra *et al*., 2008).

P. plectranthoides Desf. **(Pachouli/Bhantwas)**

A large aromatic herb. Leaves ovate, serrate, acute or acuminate, base sub-obtuse, pubescent beneath. Flowers white tinged with pink, in pubescent cylindrical spikes. Calyx 5. Corolla 2-lipped. Stamens 4, didynamous. Fruits nutlets brown.

Decoction of leaves used as stimulant and styptic (Ambasta, 2006).

Polygonum glabrum Willd. **(Bihagni)**

An erect or decumbent herb. Leaves lanceolate or linear, shining, gland dotted, ochreate stipules, tubular closely sheathing the stem. Flowers pink or white, in terminal panicles. Bracts tubular, glabrous. Perienth 4-5, coloured. Stamens 6-9. Fruits nutlets dark brown, shining.

Infusion of leaves given in colic and as a febrifuge. Root stocks used for piles, jaundice debility and consumption (Chopra *et al*., 2006).

Salvia plebeia R.Br. **(Bhu-tulasi)**

An erect pubescent annual herb with obtusely grooved quadrangular stems. Leaves ovate to lanceolate, crenate, obtuse base, acuminate, glabrous or hairy. Flowers white to bluish-white in spicate racemes. Calyx tubular or companulate, bilipped. Corolla 2-lipped. Stamens 2. Fruits small nutlets, ovoid, brown.

Seeds used in diarrhoea, plant diuretic and anthelmintic (Ambasta, 2006).

Siegesbeckia orientalis Linn. **(Katampam)**

An erect, branched annual herb. Leaves simple, petiolate, opposite, ovate with cuneate base, acute, at the apex irregularly serrate-dentate, pubescent on both surfaces. Heads yellowish, heterogamous in lax panicles. Receptacle convex with elliptic-ovate, glandular-hairy palaeaceous

bracts. Corolla 5, tubular. Stamens 5, syngenesious. Fruits cypsela, dark brown. Pappus absent.

Said to be possesses healing properties in gangrenous ulcers and sores. Also diaphoretic and cardiotonic (Chopra *et al*., 2006).

RESULTS AND DISCUSSION

The aromatic plants collected during investigation are listed in Table 1. It shows that species ordered alphabetically by family, place of collection with collection number, intensity of occurrence, flowering/fruiting and habit/ habitat. A total 44 aromatic plant species belonging to 32 genera and 14 families were collected from different forests of Gorakhpur Division. Asteraceae showed 13 aromatic plants followed by Lamiaceae (10) however Araceae, Cannabinaceae, Capparidaceae, Chenopodiaceae and Polygonaceae were represented by only one species. Out of 44 species, 7 species belong to monocot family. During excursions the species viz., *Lantana camara*, *L. indica*, *Ocimum canum*, *Pogostemon* spp., and *Cannabis sativa* were found to be abundantly distributed throughout the forests while the species like *Adenostemma lavenia* (Tehrighat, Kushinagar), *Clausena pentaphylla* (Pakari, Nichlaul and Kushmahi), *Hygrophilla pinnatifida*, *Eupatorium cannabinum*, (Kushmahi), *Siegesbeckia orientalis*, *Curcuma aromatica* and *Gynura nepalensis* (Nichlaul) showed restricted distribution. *Leonurus sibiricus* was recorded from Sahajanawa and Gorakhpur while *Piper sylvaticum* was reported only from Madanpur forest. Remaining species were distributed freely in surveyed areas. *C. aromatica*, *G. nepalensis*, *P. heyneanus* and *P. sylvaticum*, were reported for the first time in these areas.

Table 1: Aromatic plants of forests of Gorakhpur Division.

Plants name (Common name)	Family	Occurrence	Place of collection/Collection no.	Flowering & fruiting	Habit & Habitat
1	2	3	4	5	6
Acorus calamus Linn. (Bach)	Araceae	Uncommon	Doma forest, Kushmahi forest/GKU4380	Apr.-Jul.	Rhizomatous herb or under shrub/ Herb undergrowth in Sal forest
Adenostemma lavenia (L.)O Kuntze. (Bhenguar)	Asteraceae	Occasionally present	Tehrighat forest, Kushinagar/GKU4348	Feb.-May.	Shrub/Along bank of canal, shady places
Artemisia nilagirica Linn. (Dauna))	,,	Uncommon	Nichlaul forest, Pakari forest, Kushinagar/GKU4365	Dec.-Apr.	Shrub/Along road side
Blumea eriantha DC. (Kukaraunha)	,,	common	Chowk forest, Achalgarh forest, Doma forest /GKU4306	Dec.-Apr.	Herb/Dry waste places, along road side
B. laciniata DC. (Kukaraunha)	,,	,,	Kushmahi forest, Banki forest, Lehradevi forest /GKU4363	Jan.-Apr.	,,
B. mollis (D. Don) Merr. (Kukaraunha)	,,	,,	Nichlaul forest, Madhaulia forest, Campierganj forest /GKU4392	Feb.-May.	..
Caesulia axillaris Roxb. (Bangra)	,,	Uncommon	Banki forest, Kushmahi forest/GKU4351	Sep.-Jan	Herb/In the field of rice, shady places
Callicarpa macrophylla (L.) Vahl. (Priyangu)	Verbinaceae	Uncommon	Nichlaul forest, Kushmahawa forest, Madanpur forest/GKU4338	Jul.-Jan.	Shrub/Shrubby under in Sal forest
Cannabis sativa Linn. (Bhang)	Cannabinaceae	Abundent	Banki forest, Kushmahi forest, Tilkonia forest /GKU4391	Jan.-Dec.	Herb/Along road side, railway track
Chenopodium ambrosioides Linn. (Ban bhathuwa)	Chenopodiaceae	Uncommon	Kushmahi forest, Kushinagar/GKU4346	Jun.-Sep.	Herb or under shrub/ Along bank of canal
Clausena pentaphylla (Roxb.) Dec. (Ratanjot)	Rutaceae	Uncommon	Kushmahi forest, Pakari forest, Nichlaul forest /GKU4354	Mar.-Jul.	Shrub/Shrubby undergrowth in Sal forest

Contd..

1	2	3	4	5	6
Colebrookea oppositifolia Sm. (Bantulsi, Pansra)	Lamiaceae	Uncommon	Tehrighat forest, Nichlaul forest, Madanpur forest /GKU4336	Dec.-Mar.	Shrub/Shruby undergrowth in Sal forest
Curcuma aromatica Salisb. (Jangali-haldi)	Zingiberaceae	Occasionally present	Nichlaul forest/GKU4316	Dec.-Mar.	Rhizomatous herb/ Harb under growth in Sal forest
C. zedoaria Rose. (Kachura)	,,	Common	Banki forest, Tilkonia forest, Lehradevi forest/GKU4377	Jan.-Jun.	Underground shrub/ Waste land
Cryperus brevifolius (Rottb.) Hassk. (Mutha)	Cyperaceae	,,	Kushmahi forest, Banki forest, Gorakhpur/GKU4372	Aug.-Nov.	Herb/Grassland
C. monocephalus Endl. (Musta)	,,	Abundent	Pakari forest, Achalgarh forest, Gorakhpur/GKU4329	Sept.-Nov.	,,
C. triceps (Rottb.) Endl. (Motha)	,,	Uncommon	Kushmahi forest, Banki forest/GKU4370	Jul.-Oct.	Herb/In Sal forest
C. triceps (Rottb.) Endl. (Apavisha)	,,	,,	Kushmahi forest, Doma forest, Gorakhpur/GKU4327	Sept.-Nov.	Herb/Grassland
Erigeron bonariensis Linn. (Bonaria)	Asteraceae	Common	Kushmahi forest, Kushinagar, Achalgarh forest/GKU4305	Mar.-Aug.	,,
E. conadensis Linn. (Jarayupriya)	Asteraceae	Common	Banki forest, Kushinagar, Gorakhpur/GKU4303	Jun.-Sept.	Herb/Grassland
Eugenia heyneana (L.) Wall. (Kathjamun)	Myrtaceae	,,	Tehrighat forest, Madhaulia forest, Kushmahi forest /GKU4375	May.-Aug.	Shrub/Shrubby undergrowth in Sal forest
Eupatorium cannabinum Linn. (Tangol-lati)	Asteraceae	Occasionally present	Kushmahi forest/GKU4335	Jan.-Apr.	Herb/Herb undergrowth in Sal forest
Eupatorium odoratum Linn. (Ayapana)	Asteraceae	Common	Chowk forest, Nichlaul forest, Kushmahi forest/GKU4347	Dec.-Apr.	Shrub/Shrubby undergrowth in Sal forest
Glycosmis pentaphylla (Retz.) Corr; Hook. (Karjeer)	Rutaceae	,,	Nichlaul forest, Kushinagar, Campeirganj forest/GKU4345	Aug.-Dec.	Shrub/Shrubby undergrowth in Sal forest, along road side
Grangea maderaspatana (L.) Poir. (Jhinkimundi)	Asteraceae	Uncommon	Kushmahi forest, Kushinagar/GKU4344	Dec.-May.	Herb/Along bank of pond, shady places
Gynandropsis gynandra (L). Briq. (Hulhul)	Capparidaceae	Common	Banki forest, Gorakhpur, Kushmahawa forest/GKU4350	Jul.-Oct.	Herb/Along bank of pond, shady places
Gynura nepalensis DC. (Jali)	Asteraceae	Occasionally present	Nichlaul forest/GKU4366	Nov.-Feb.	Herb/Shady places, along road side
Hygrophilla difformis Linn. (Sarpat)	Acanthaceae	Uncommon	Achalgarh forest, Doma forest, Kushinagar/GKU4309	Aug.-Mar.	Herb/Shady places, along bank of rice field
H. pinnatifida Dalz. (Godadi)	,,	Occasionally present	Kushmahi forest/GKU4343	Jab.-Mar.	Herb/Along bank of canal
Lantana camara Linn. (Ghaneri)	Verbenaceae	Abundent	Banki forest, Nichlaul forest, Gorakhpur/GKU4376	Jan.-Dec.	Shrub/Along road side, railway tract.
L. indica Roxb. (Ghaneri)	,,	,,	Madhaulia forest, Doma forest, Gorakhpur/GKU4355	Oct.-Dec.	,,
Leonotis nepetaefolia R. Br. (Dhompo)	Lamiaceae	Common	Kushmahi forest, Achalgarh forest, Nichalul forest/GKU4314	Dec.-Mar.	,,

Contd..

1	2	3	4	5	6
Leonurus sibiricus Linn. (Guma)	,,	Uncommon	Gorakhpur, Sahajanawa/GKU4357	,,	Herb/Dry sandy places, along road side.
Leucas aspera Spreng. (Goma)	,,	Abundent	Tehrighat forest, Doma forest/GKU4312	May.-Jul.	Herb/Cultivated field
Leucas cephalotes Spreng. (Goma)	Lamiaceae	Common	Chowk forest, Banki forest, Kushmahawa forest /GKU4320	Jul.Sep.	Herb/Moist sandy places
Lippia nodiflora Rich. (Buuiokra)	Verbenaceae	,,	Kushmahi forest, Pakari forest, Gorakhpur/GKU4331	Jan.-Jul.	Shrub/Shady places, along road side
Nepeta hindostana Linn. (Bilaiyalotan)	Lamiaceae	Common	Madanpur forest, Kushmahi forest, Gorakhpur/GKU4322	Jan.-Feb.	Herb/Damp places
Ocimum canum Sims. (Bantulsi)	,,	Abundent	Kushmahi forest, Gorakhpur, Chowk forest /GKU4368	Dec.-Mar.	Herb/Waste places
Piper sylvaticum Roxb. (Pahari-pipal)	Piperaceae	Occasionally Present	Madanpur/GKU4353	Jul.-Aug. Dec.-Jan.	Climber/In babul forest, along railway tract
Pogostemon heyneanus Benth.(Pachouli)	Lamiaceae	Abundent	Kushmahi forest, Chowk forest, Nichlaul forest /GKU4341	Jan.-Apr.	Shrub/Shady places, along roade side
P. plectranthoides Desf. (Pachouli)	,,	,,	Doma forest, Pakari forest, Madhaulia forest/GKU4326	,,	,,
Polygonum glabrum Willd. (Bihagni)	Polygonaceae	Common	Kushmahi forest, Tilkonia forest, Gorakhpur/GKU4379	Sept.-Apr.	Herb/Shady moist places
Salvia plebeia R. Br. (Bhu-tulasi)	Lamiaceae	Uncomon	Achalgarh forest, Tehrighat forest, Kushinagar/GKU 4307	Jan.-May.	Herb/Along road side, Cultivated field
Siegesbeckia orientalis Linn. (Katampam)	Asteraceae	Occasionally present	Nichlaul forest/GKU4378	Oct.-Jan.	Herb/Along road side

Flowering and fruiting periods are the most important stage in life cycle of plant species. Seasonal flowering and fruiting elated life cycle of aromatic plants. It will assure their proper distribution and maintained their diversity in that region. The study revealed that most of the aromatic species were found to be flowering and fruiting during winter to summer transition (Table 1). The seasonal variations in flowering and fruiting observed in this study did not follow the earlier records (Ali and Dixit, 1986; Bhatt and Bhatt, 2007). This may be due to change in climatic condition because various phenological characters of plant species are regulated by environmental factors.

The plant materials either fresh or dried are being used in many ways. Fresh materials are usually taken orally or applied externally after being pounded. Recently workers reported the curative properties of ethno medicinal plants in skin disease ailment (Khumbmayung *et al*., 2005; Tripathi and Srivastava, 2010). The present study revealed that frequent use of aromatic plants is to treat gastrointestinal disorders including stomach ache, ulcers, diarrhoea, rheumatism and tooth ache. Some species like *Blumea eriantha*, *E. cannabinum* and *L. sibiricus* are diuretic used in hysteria, as purgative and heart palpitation. Further the

plants are used in treatment of respiratory tracts disorder (Cough, Bronchitis and cold) which are generally administered by gargling or by drinking a decoction. An interesting remedy is the use of *Leonotis nepetaefolia* inflorescence in treatment of cough. The Inflorescence put in 50gm ghee, boiled to viscous paste and orally administered two spoon full a day for cough. Plants boiled in mustered oil and applied over waist to relieve pain.

Science engaged in multipurpose utilization of aromatic plants which may lead to decrease in species abundance and finally, even to local extinction. Plant species such as *A. lavenia, C. aromatica, E. cannabinum, G. nepalensis, H. pinnatifida, P. sylvaticum* and *S. orientalis* were found to be occasionally distributed in the forests of Gorakhpur Division. The medicinal and aromatic plants have future potential to develop herbal medicines for various disease ailments. So people should have knowledge the importance of plant species in the community. By applying this, a sustainable system should be developed for conservation of aromatic plants. Hopefully this study will positively contribute to further research and conservation of aromatic plant resources as well as to represent important assets to the health care.

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REFERENCES

Ali, S.J. and Dixit, S.N. (1986). Phenological observation on the flora of A Sub-Himalayan Forest. *Res. J. Pl. Environ.*, **3:** 37-44.

Ali, S.J. & Dixit, S.N. (1989). Survey of medicinal plants of A Sub-Himalayan Forest. *Bio Journal*, **1:** 13-18.

Ambasta, S.P. (2006). The *useful plants of India*, Publishers National Institute of Science Communication Dr K S Krishnan Marg New Delhi.

Asolkar, L.V., Kakkar, K.K. & Chakre, O.J. (2005). Second supplement to *Glossary on Indian Medicinal Plants with Active Principles*, Publishers National Institute of Science Communication Dr K S Krishnan Marg New Delhi.

Awasthi, A.K. (1991). Ethnobotanical studies of the Negrito Islanders of Andaman Islands, India- The great Andmanese. *Economic Botany,* **45:** 274-280.

Bhatt, B. & Bhatt, N. (2007). Floristic and Phenological analysis of ground vegetation grown under *Eucalyptus* hybrid and *Dalbergia sisso* plantation. *J. Indian Bot. Soc.,* **86:** 123-128.

Chopra, R.N. ; Nayar, S.L. & Chopra, I.C. (2006). *Glossary of Indian Medicinal Plants*, Publishers National Institute of Science Communication Dr K S Krishnan Marg New Delhi.

Choudhury, M.D. ; Bawari, M. & Singha, L.S. (2010). Some Antipyretic Ethno-medicinal Plants of Manipuri community of Barak Valley, Assam, India. *Ethnobotanical Leaflets*,**14:** 21-28.

Debasish, D. ; Ghosh, S. ; Roy, A.K. ; Haque, R. & Samanta, S. (2010). Study of antioxidant activity of *Hygrophila difformis*. *Int. J. Drug Dev. & Res.,* **2:** 113-120.

Kala, C.P. (2005) Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India. *Journal of Ethnobiology and Ethnomedicine*, **1**: 11.

Khumbmayung, A.D. ; Khan ; M.L. & Tripathi, R.S. (2005). Ethnomedicinal plants in the sacred groves of Manipur. *Indian J Traditional Knowledge,* **4:** 21-32.

Kosalge, S.B. & Fursule ; R.A. (2009) Investigation on ethnomedicinal claims of some plants used by tribals of Satpuda Hills in India. *J Ethanopharmacol*, **121:** 456-461.

Mishra, S.B. ; Dwivedi, S. ; Shashi, A. & Prajapati, K. (2008). Ethnomedicinal Uses of Some Plant Species by Ethnic and Rural Peoples of the Salem District of Tamilnadu with Special Reference to the Conservation of Vanishing Species. *Ethnobotanical Leaflets,* **12:** 873-87.

Natrajan, B. ; Paulsen, B.S. & Pushpangadan, P. (1999). An ethnopharmacological study from the Coimbatore district, Tamilnadu India: Traditional knowledge compared with modern biological science. *Pharm. Bio.,* **37:** 378-390.

Singh, N.P. ; Karthikeyan, S. ; Lashminarasimhan, P. & Prasanna, P.V. (2000). *Flora of Maharashtra State*, (Botanical Survey of India, Calcutta).

Srivastava, T.N. (1976). *Flora Gorakhpurensis*, Today & Tomarrow Printers and Publishers, New Delhi.

Tomar, A. (2008). Some folk medicinal plants in Muzaffarnagar district of Western Utter Pradesh India. *J. Indian Bot Soc.*, **87:** 200-208.

Tripathi, S.C. & Srivastava, M. (2010). Ethnomedicinal flora of Euphorbiaceae used in dermatological problems. *Indian J Traditional Knowledge,* **9:** 318-320.

Uniyal, S.K. ; Awasthi, A. & Rawat, G.S. (2002). Current status and distribution of commercially exploited medicinal and aromatic plants in upper Gori valley, Kumaon Himalaya, Uttaranchal. *Current Science*, **82:** 1246-1252.